CHROMOSOME BEHAVIOR IN CALYCANTHUS

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With four text figures

TWO SPECIES of *Calycanthus* are found in eastern United States. *Calycanthus floridus* L. is found from Virginia to Florida while *C. fertilis* extends from Pennsylvania to Georgia and Alabama (Rehder, 1927). Herbarium material in the Arnold Arboretum includes *C. fertilis* from eleven localities in North and South Carolina and Georgia, and *C. floridus* from fifteen localities in South Carolina, Georgia and Alabama. The ranges of the two species overlap to some extent, but there is little evidence of hybridization although the two species are similar, differing chiefly in leaf characters. Varieties of the two species have been described, but in the case of *C. floridus* at least, the variety (*ovatus*) is rare and is apparently known only in cultivation, and appears to be of European garden origin.

Chromosome counts were obtained from one plant of *C. fertilis,* two plants of *C. floridus,* and two varieties of these species. In both species there are eleven pairs of chromosomes at meiosis. The homologous chromosomes are united by terminal or subterminal chiasmata. The chiasma frequency is somewhat less than two per bivalent at early metaphase. Some of the chromosomes are apparently heterobrachial and the separation of the short arms at late metaphase and early anaphase gives the impression of a prevalence of rod bivalents at the later stages although at early metaphase most of the chromosomes are ring bivalents. The chromosomes of *C. fertilis* are shown at early metaphase (Fig. 1) and those of *C. floridus* are shown at late metaphase of the first meiotic division (Fig. 2).

A variety of *C. fertilis* also had eleven pairs of chromosomes which pair and divide regularly at meiosis. The other variety in the Arboretum, *C. floridus ovatus,* is a triploid. At meiosis there are often eleven trivalents, although from one to four univalents are usually found. The trivalents are found in the form of chains, rings and rods, and Y's (Fig. 3). There is some irregularity in the first meiotic division, including both trivalents and univalents, and the chromosomes are distributed irregularly to the poles. The chromosomes at second metaphase following a comparatively regular division are shown in Figure 4. In one case a distribution of 20-13 was observed, but as a rule the numbers of chromosomes passing to each pole are approximately equal. Occasionally more than thirty-three chromosomes are found at the two poles, due presumably to a precocious division of one or more univalents.

The pollen sterility of the triploid is about fifty per cent as compared with about five per cent in each of the pure species.

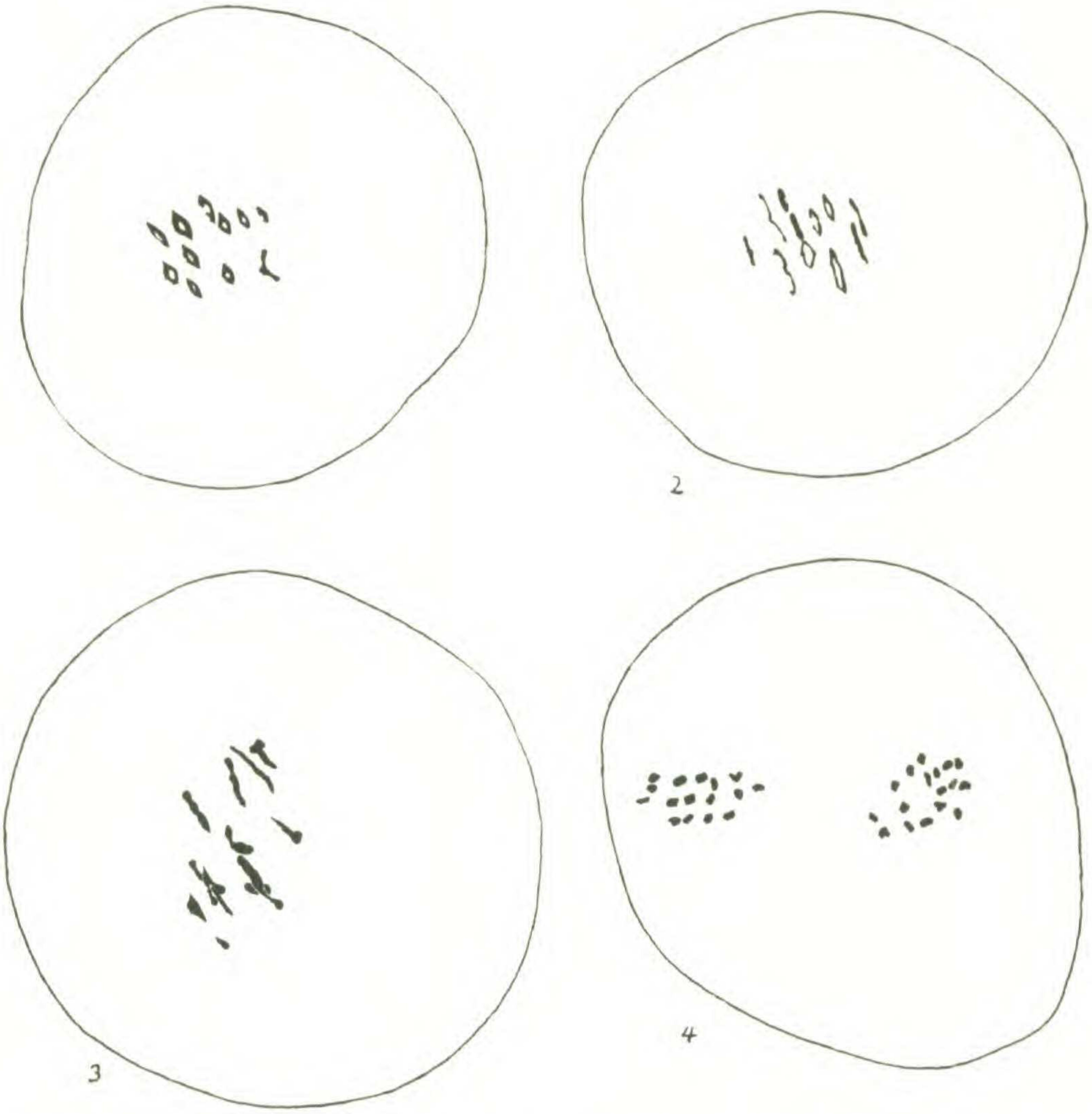

Figure 1. CALYCANTHUS FERTILIS: chromosomes at early metaphase of the first meiotic division.—Figure 2. CALYCANTHUS FLORIDUS: late metaphase.—Figure 3. CALYCANTHUS FLORIDUS OVATUS: a triploid showing trivalent chromosomes at meiosis.—Figure 4. The triploid variety showing chromosome distribution at the second meiotic division.—The figures were drawn from aceto-carmine preparations. Magnification × 1200.

Since the two species of *Calycanthus* are similar in taxonomic characters and overlap in their distributions, the occurrence of natural hybrids might be expected. Some of the diploid varieties may be of hybrid origin, but there seems to be no extensive hybridization, and the two species are rather well differentiated. It is possible that tetraploid forms of these species exist and that the triploid variety is a hybrid between a tetraploid, *C. floridus* and a diploid *C. fertilis,* but it seems more probable that the *ovatus* variety is an autotriploid. The two plants of *C. floridus* in the Arboretum are typical for the species and both are diploids. The variety *ovatus* originated, or was first found, in a European garden and is not known to occur in nature. No species of *Calycanthus* is a native of Europe.

Chromosome irregularity and pollen sterility have been considered as evidence of hybridity. In the case of *Calycanthus floridus ovatus* it is improbable that chromosome irregularity and pollen sterility can be attributed to species hybridization. An autotriploid originating within a species would be expected to show the chromosome irregularities and pollen sterility. Chromosome irregularity at meiosis and pollen sterility can also be caused by segmental interchange with absolutely no change in the taxonomic characters of the plants involved. *Tradescantia edwardsiana,* for example, is a well marked species. The occasional segmental interchange plants show about fifty per cent pollen sterility, although they are taxonomically the same as the normal fertile plants (Sax & Anderson 1933).

Chromosome irregularities may also be caused by variations in temperature and by genetic factors. On the other hand species hybrids often show regular chromosome pairing and division. In some of these hybrids there is much pollen sterility, but others are relatively fertile. Undoubtedly wide species crosses often result in hybrids which exhibit irregular chromosome behavior at meiosis, but chromosome irregularity is not necessarily evidence of species hybridization.

LITERATURE CITED

REHDER, A. (1927). Manual of cultivated trees and shrubs. Pp. 930. (O. McMillan Co., New York.)

SAX, KARL & EDGAR ANDERSON (1933). Segmental interchange in chromosomes of Tradescantia. (Genetics, **18**:53–67.)

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